

REMARKS

Applicant would like to thank the Examiner for the careful consideration given the present application. The application has been carefully reviewed in light of the Office action, and amended as necessary to more clearly and particularly describe the subject matter which applicant regards as the invention.

Claims 1-15 remain in the application. Claims 9-15 have been allowed. Claim 3 has been indicated as containing allowable subject matter. Claim 3 has been rewritten in independent form herein. Claims 1, 2 and 4-8 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Japanese Patent 01-097813 to Yasuda (hereinafter Yasuda) in view of U.S. Patent 5,327,218 to Igaki (hereinafter Igaki). For the following reasons, the Examiner's rejection is traversed.

The present invention is directed to an emitting light source apparatus of a reflection-type for use in an optical encoder which applies light to a reflecting scale having an optical grating formed along an axis of measurement and which receives the reflected light from the scale with a light-receiving element to output a displacement signal. The apparatus includes a first optical element provided at an end face of a molded transparent resin which faces a light emitting surface of a light emitting chip. The first optical element reflects the light from the light-emitting chip substantially parallel to the optical grating surface and in a direction orthogonal to the direction of the optical grating. A second optical element is provided at the other end face of the molded transparent resin and reflects the parallel light from the first optical element toward the optical grating and illuminates the optical grating over a specified area in the direction of the optical grating as the reflected parallel light is

converged toward the optical grating. With this design, the parallel light from the second optical element illuminates the optical grating over an area wider than the length of the light-receiving element in the direction of the optical grating and the reflected light from the optical grating is received by the light-receiving element. Thus, the received light contains the information from the light applied over an area wider than the length of the light-receiving element in the direction of the optical grating. Hence, the errors due to waviness in the scale, stain and pitch deviations can be sufficiently averaged to enable more precise detection.

Yasuda discloses an optical displacement detector that includes a light emitting element for illuminating a measuring scale. Light from the element is reflected by a reflecting mirror with a concave surface. The reflected light is then directed by a planar reflecting mirror through a light transmitting resin mold to the measuring scale. The scale reflects the light toward a light receiving element in the light transmitting resin mold. The light emitting element and light-receiving element are die-bonded to a common lead frame.

Igaki (Fig. 6 reproduced below) discloses an apparatus including an embodiment having a semi-conductor laser 1 that generates a beam. The beam is converged by a lens system 2. The convergent beam is incident on a first grating G1 of a scale. The beam is focused at two grating surfaces G1 and G2 formed in the scale. The scale also includes a reflecting surface M that reflects the beams back through the gratings and to a half mirror 5. The half mirror guides the reflected beam to a photodetector 3.

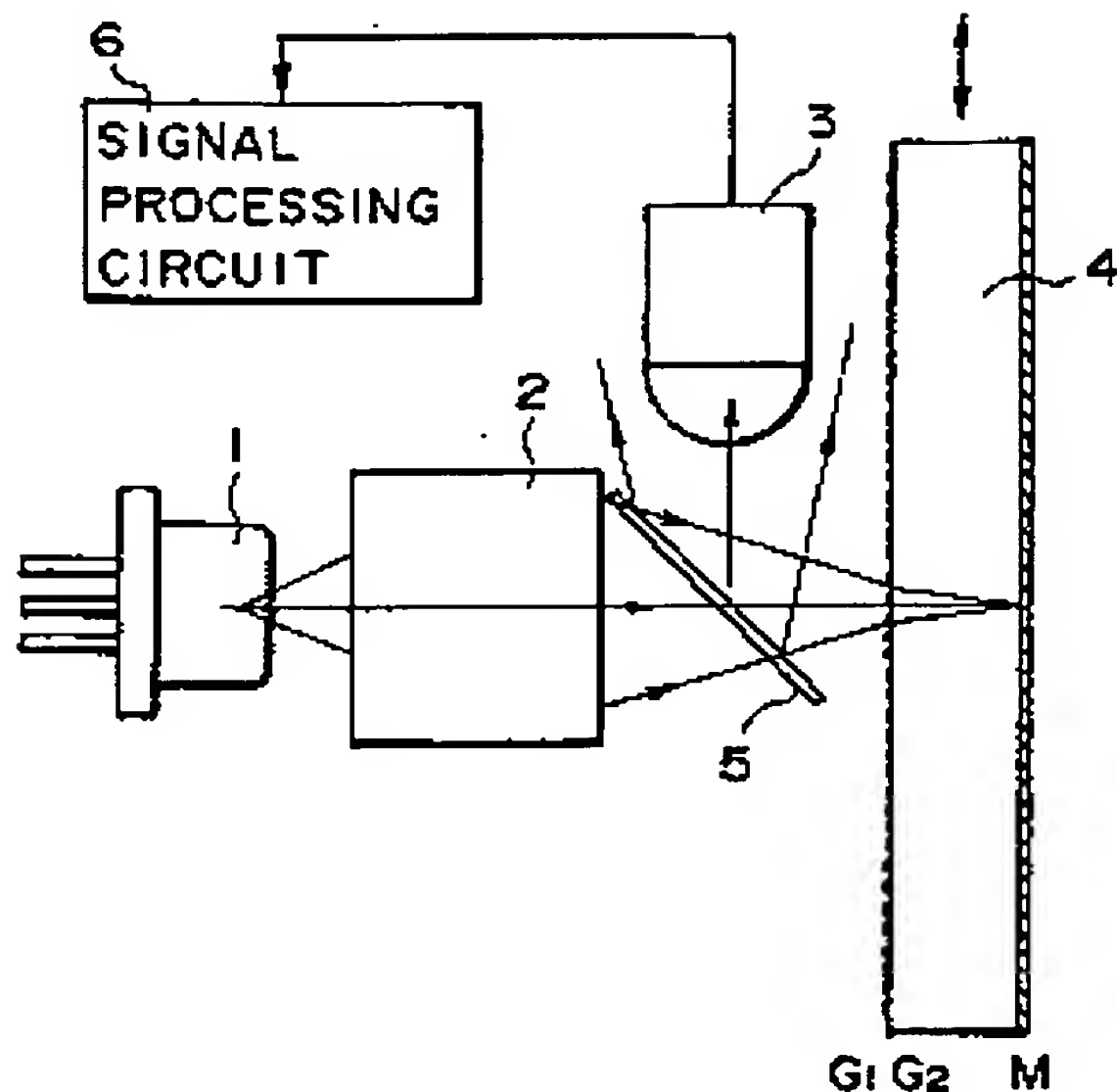


FIG. 6

Even if the references were combined in the manner proposed by the Examiner, the present invention would not result. Neither reference, either alone or in combination, teaches "a second optical element reflecting the parallel light from said first optical element and focusing the reflected light toward the optical grating", as required by claim 1. Rather, the proposed combination teaches a device with an element that reflects light (planar reflecting mirror 29 from Yasuda) and a different element (element 2 from Igaki) that focuses light toward a grating. However, a single optical element that both reflects and focuses, as required, is not taught by the combination of the claims. There is simply no teaching of a single element that performs both functions or teaching of a way to modify one of the elements to perform the additional reflecting/focusing function. Applicant respectfully disagrees that it would have been obvious to one of ordinary skill in the art to create such an element. Thus, even if the Yasuda and Igaki patents were combined, the invention

defined in claim 1 would not result.

Further, there is no motivation or suggestion in the art of record to combine the Yasuda and Igaki references in the manner proposed by the Examiner. Although both references are directed to devices projecting light onto measuring scales, the systems perform their function using different structures. Igaki is directed to a so-called Ronchi interferometer or the like where an interference image is generated by a convergent beam. The Ronchi type interferometer does not require a stationary grating. Yasuda, alternatively, is directed to a more common dual grating system, where the interference image is generated using both a stationary and movable grating and has an intensity that changes based on the relative position of the gratings.

The Examiner states that it would have been obvious to one of ordinary skill in the art to provide the convergent lens system 2 of Igaki in the second reflecting mirror of Yasuda. However, it is noted that the Igaki lens system 2 does not receive light reflected from a first optical element, but rather receives light directly from the laser 1. Thus, the Igaki lens system may only be related to the claimed 'first optical element' of claim 1, not the second optical element, contrary to the Examiner's proposed combination. Further, because Yasuda is a detector with stationary and moving gratings, there is no need to generate a converging beam, and, therefore, one of ordinary skill in the art of encoders with stationary and moving gratings would not look to a Ronchi type interferometer of Igaki to make improvements to their designs. Thus, there is no motivation to combine the teachings of Yasuda and Igaki.

In light of the foregoing, it is respectfully submitted that claim 1 is patentable over the art of record. Further, claims 2, and 4-6, which depend from claim 1, are

likewise considered to be allowable over the art of record. Reconsideration and withdrawal of the rejections of claims 1, 2 and 4-6 is respectfully requested.

In light of the foregoing, it is respectfully submitted that the present application is in a condition for allowance and notice to that effect is hereby requested. If it is determined that the application is not in a condition for allowance, the Examiner is invited to initiate a telephone interview with the undersigned attorney to expedite prosecution of the present application.

If there are any additional fees resulting from this communication, please charge same to our Deposit Account No. 18-0160, our Order No. NGB-12970.

Respectfully submitted,

RANKIN, HILL, PORTER & CLARK LLP

By 
James A. Balazs, Reg. No. 47401

4080 Erie Street
Willoughby, Ohio 44094-7836
(216) 566-9700